

Evaluation of Soil Amendment Technologies at the Crooksville/Roseville Pottery Area of Concern STAR Organics Soil Rescue

Innovative Technology Evaluation Report

National Risk Management Research Laboratory
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Notice

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Foreword

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Hugh McKinnon, Director
National Risk Management Research Laboratory

Abstract

Star Organics, L.L.C., of Dallas, Texas (Star Organics), has developed Soil Rescue to treat soil contaminated with metals. Star Organics claims that Soil Rescue forms metal complexes that immobilize toxic metals, thereby reducing the risk to human health and the environment.

The Superfund Innovative Technology Evaluation (SITE) Program evaluated an *in situ* application of the technology during a demonstration at two lead contamination sites in Roseville, Ohio, in September 1998. For the demonstration, Soil Rescue was applied to 10 experimental units at a trailer park and one experimental unit at an inactive pottery factory.

Primary objective 1 (P1) was to evaluate whether Soil Rescue can treat soil contaminated with lead to meet the Resource Conservation and Recovery Act (RCRA)/Hazardous and Solid Waste Amendments (HSWA) alternative universal treatment standards (UTS) for land disposal of soils contaminated with lead. The alternative UTS for soil contaminated with lead is determined from the results of the toxicity characteristic leaching procedure (TCLP). The alternative UTS is met if the concentration of lead in the TCLP extract is no higher than one of the following: (1) 7.5 milligrams per liter (mg/L), or (2) 10 percent of the lead concentration in the TCLP extract from the untreated soil. Contaminated soils with TCLP lead concentrations below the alternative UTS meet the RCRA land disposal restrictions (LDR), and thus are eligible for disposal in a land-based RCRA hazardous waste disposal unit. The alternative UTS is defined further under Title 40 of the Code of Federal Regulations (CFR), Chapter I, part 268.49 (40 CFR 268.49). To meet that objective, soil samples were collected before and after the application of Soil Rescue. The untreated and treated soil samples were analyzed for TCLP lead concentrations to evaluate whether the technology met objective P1. Analysis of the data demonstrated Soil Rescue reduced the mean TCLP lead concentration at the inactive pottery factory from 403 mg/L to 3.3 mg/L, a reduction of more than 99 percent. Therefore, the treated soil meets the alternative UTS for soil at the inactive pottery factory. Data from the trailer park were not used to evaluate P1 because TCLP lead concentrations in all treated and untreated soil samples from this location were either at or slightly higher than the detection limit of 0.05 mg/L.

Primary objective 2 (P2) was to evaluate whether Soil Rescue could decrease the soil lead bioaccessibility by 25 percent or more, as defined by the Solubility Bioaccessibility Research Consortium's (SBRC) Simplified In-Vitro Test Method for Determining Soil Lead and Arsenic Bioaccessibility (simplified in vitro method [SIVM]). However, EPA Lead Sites Workgroup (LSW) and Technical Review Workgroup for lead (TRW) at this time, do not endorse an in-vitro test for determining soil lead bioaccessibility (Interstate Technology and Regulatory Cooperation [ITRC] 1997). To meet objective P2, soil samples were collected before and after the application of Soil Rescue. The soil samples were analyzed for soil lead bioaccessibility to evaluate whether the technology met objective P2. Analysis of the data demonstrates that Soil Rescue reduced the soil lead bioaccessibility by approximately 2.9 percent, which is less than the project goal of at least a 25 percent reduction in soil lead bioaccessibility. However, it was recognized early on that meeting this goal would be difficult because the SIVM test procedure used in the demonstration involves a highly acidic sample digestion process, which may be revised in the future, because it may be exceeding the acid concentrations that would be expected in a human stomach.

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Acronyms, Abbreviations, and Symbols

ACGIH TLV	American Conference of Governmental Industrial Hygiene Threshold Limit Value
ASTM	American Society for Testing and Materials
ARAR	Applicable or relevant and appropriate requirements
BS	Blank spike
CaCO ₃	Calcium carbonate
CFR	<i>Code of Federal Regulations</i>
CEC	Cation exchange capacity
CRPAC	Crooksville/Roseville Pottery Area of Concern
cm ³	Cubic centimeter
DQO	Data quality objective
DUP	Duplicate
Eh	Oxidation reduction potential
EPA	U.S. Environmental Protection Agency
EP-TOX	Extraction procedure toxicity test
GI	U.S. Environmental Protection Agency Regional Geographic Initiative
HSWA	Hazardous and Solid Waste Act
ICP-AES	Inductively coupled plasma-atomic emission spectrometry
ITER	Innovative technology evaluation report
LCS	Laboratory control samples
LCSD	Laboratory control sample duplicates
MS	Matrix spike
MSD	Matrix spike duplicate
MEP	Multiple extraction procedure
μg/dL	Micrograms per deciliter
Meq/g	Milliequivalents per gram
mg/kg	Milligram per kilogram
mg/L	Milligram per liter
mV	Millivolt
NAAQS	National Ambient Air Quality Standard
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

Acronyms, Abbreviations, and Symbols (continued)

NIOSH REL	National Institute for Occupational Safety and Health recommended exposure limit
NPDES	National Pollutant Discharge Elimination System
NRMRL	National Risk Management Research Laboratory
OEPA	Ohio Environmental Protection Agency
ORD	Office of Research and Development
OSHA	Occupation Safety and Health Administration
OSHA PEL	Occupation Safety and Health Administration permissible exposure limit
OSWER	Office of Solid Waste and Emergency Response
PBET	Physiologically based extraction test
%R	Percent recovery
POTW	Publicly owned treatment works
PPE	Personal protective equipment
PRDL	Project-required detection limits
PRP	Potentially responsible party
QAPP	Quality assurance project plan
QA/QC	Quality assurance and quality control
RCRA	Resource Conservation and Recovery Act
RMRS	Rocky Mountain Remediation Services, L.L.C.
RPD	Relative percent difference
RPM	Remedial Project Manager
SARA	Superfund Amendments and Reauthorization Act
SBRC	Solubility/Bioavailability Research Consortium
SITE	Superfund Innovative Technology Evaluation
SIVM	Simplified in-vitro method
SPLP	Synthetic precipitation leaching procedure
SVOC	Semivolatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
TER	Technology Evaluation Report
$\mu\text{g}/\text{kg}$	Microgram per kilogram
$\mu\text{g}/\text{L}$	Microgram per liter
UTS	Universal treatment standard
VOC	Volatile organic compound
yd^3	cubic yard

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